Onondaga County Department of Water Environment Protection:

Process Optimization Saves Energy at Metropolitan Syracuse Wastewater Treatment Plant

Benefits

- Saves $207,500 annually
- Saves about 2.81 million kWh per year
- Reduces natural gas purchases by 270 MMBtu annually
- Achieves a 13-month simple payback

Applications

Wastewater treatment plants are good candidates for process optimization projects. Treatment process systems can consume a significant amount of the energy used by wastewater plants. Optimizing these systems can save energy and improve system efficiency.

Project Summary

To improve the efficiency of the plant's wastewater treatment process, engineers at the Metropolitan Syracuse Wastewater Treatment Plant (Metro WWTP) in Onondaga County, New York, upgraded several processes beginning in 2004. The process pumps and motors were evaluated by Thomas Devine, an employee of Stearns & Wheler LLC and a Qualified Pump System Specialist. His assessment led to a system-level project that improved the plant's energy efficiency and validated the pump maintenance program. The project involved retrofitting motors, changing the process operating strategy, and upgrading impellers. These measures significantly improved process efficiency, yielding annual electricity savings of about 2.81 million kWh and natural gas savings of 270 MMBtu. Resulting annual cost savings are $207,500. At a total cost of $233,000, these measures achieved a 13-month simple payback. The New York State Energy Research and Development Authority (NYSERDA) provided grant funding for the project's feasibility study.

Plant/Project Background

Metro WWTP provides wastewater treatment for 270,000 people and many industrial and commercial customers in the city of Syracuse and other areas in Onondaga County. The plant treats an average of 80 million gallons of wastewater daily. The wastewater treatment process includes a waste-activated sludge process served by six 25-horsepower (hp) pumps, eight aeration tanks served by thirty-two 100-hp blowers, and a low-lift pumping station that includes five 600-hp pumps.

Two U.S. Department of Energy (DOE) BestPractices tools, the Pumping System Assessment Tool (PSAT) and MotorMaster+, were used to evaluate the pumps and motors in the wastewater treatment process. One opportunity to save energy discovered by using MotorMaster+ was to retrofit the motors on waste-activated sludge pumps with more efficient units having variable-frequency drives (VFDs). Another was to modify the process control of the secondary treatment activated sludge process to stop wastewater nitrification in the aeration tanks. This was made possible by a recently installed biological aeration filtration system that provides wastewater nitrification year-round. Also, some low-lift impellers were more than 25 years old and worn from abrasion. The PSAT revealed the potential efficiency gains that would result from replacing the impellers instead of repairing them. In addition, the waste gas burner controls needed adjustment.

Metro WWTP engineers began implementing the recommendations that came out of the analysis by removing the throttling valves and replacing motors on the waste-activated sludge pumps with premium-efficiency motors fitted with VFDs. Next, the operating strategy of the activated sludge process was changed to stop wastewater nitrification in the aeration tanks, reducing the number of 100-hp blowers required to operate from 21 to 13. Then, the impellers on some of the low-lift pumps were repaired and others were replaced. Finally, plant engineers recalibrated the waste gas burner controls to maximize waste gas usage.

Results

These modifications improved the efficiency of the plant's wastewater treatment process and yielded important energy savings. Replacing the waste-activated sludge pump motors with VFD-fitted premium-efficiency units, shutting down the aeration blowers, and improving the efficiency of the low-lift pumps lowered the plant's annual energy consumption by 2,810,000 kWh, for a cost savings of $207,500. In addition, better control of the waste gas reduced natural gas purchases by 270 MMBtu per year, for a cost saving of $1,500. Total implementation costs were $233,000, for a simple payback of 13 months.

Lesson Learned

Changes in technologies and processes often represent significant opportunities for energy savings in wastewater treatment and other industrial plants. Realizing when such evolutions occur and remodeling motor and process systems in response to new parameters can save energy and improve productivity. At the Onondaga County plant, an analysis that made use of the PSAT and MotorMaster+ tools helped plant engineers decide how to optimize the wastewater treatment process. Using VFDs, more efficient pumps, and a new filtration system, plant aeration requirements were reduced from 21 large blowers down to 13. Projects and methodologies such as these can be applied at virtually all wastewater treatment and industrial facilities that require water for process needs.

Thomas W. Devine

Project Partners

Onondaga County Department of Water Environment Protection

Metropolitan Syracuse Wastewater Treatment Plant
Syracuse, NY

Stearns & Wheler LLC
Cazenovia, NY

Partner Profile

Thomas W. Devine is a Qualified Pump System Specialist with more than 12 years of experience in the planning, design, construction, and start-up of the power distribution, control, and instrumentation systems that can be found in municipal, industrial, and commercial facilities. In his current role at Stearns & Wheler LLC, he specializes in process and energy audits and evaluations for municipalities and industrial plants.

Qualified Specialists

Qualified Specialists are industry professionals who identify cost-cutting and efficiency opportunities in industrial plants. Experienced professionals who complete a qualification training workshop and exam for specific DOE-developed software tools receive special designations, and they can use these tools to help plants reduce costs, decrease maintenance and downtime, and improve productivity. The training recognizes and enhances a professional's expertise in the use of DOE's AIRMaster+ software tool, Pumping System Assessment Tool, Process Heating Assessment and Survey Tool, and Steam System Tools.

BestPractices is part of the Industrial Technologies Program, and it supports the Industries of the Future strategy. This strategy helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and energy-management best practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

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